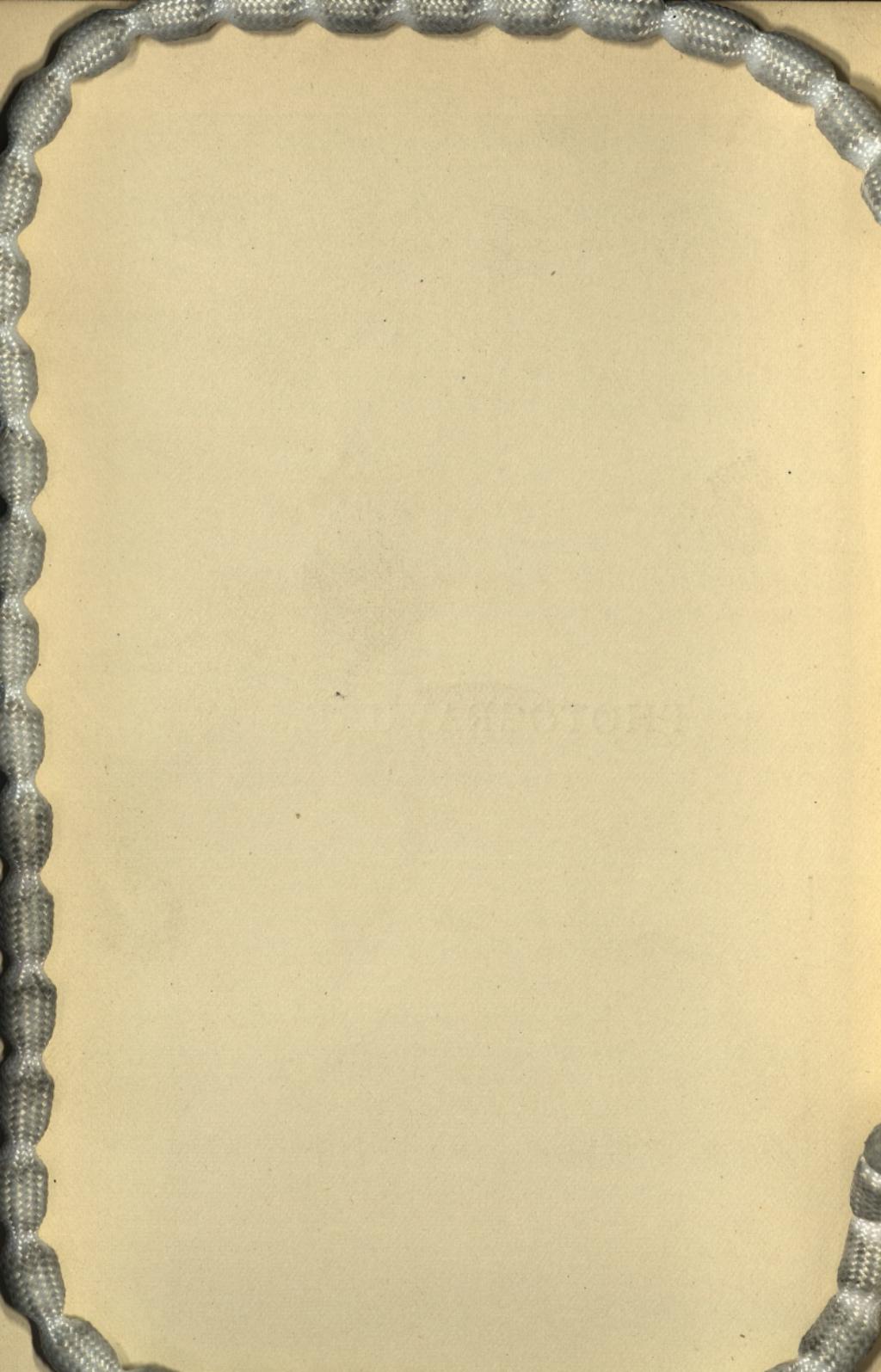


PHOTOGRAVURE.



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# PHOTOGRAPHURE

BY

W. T. WILKINSON.

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*With Illustration by W. L. Colls.*

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LONDON :

ILIFFE & SON, 3, ST. BRIDE STREET, E.C.

1890.

ILIFFE & SON,

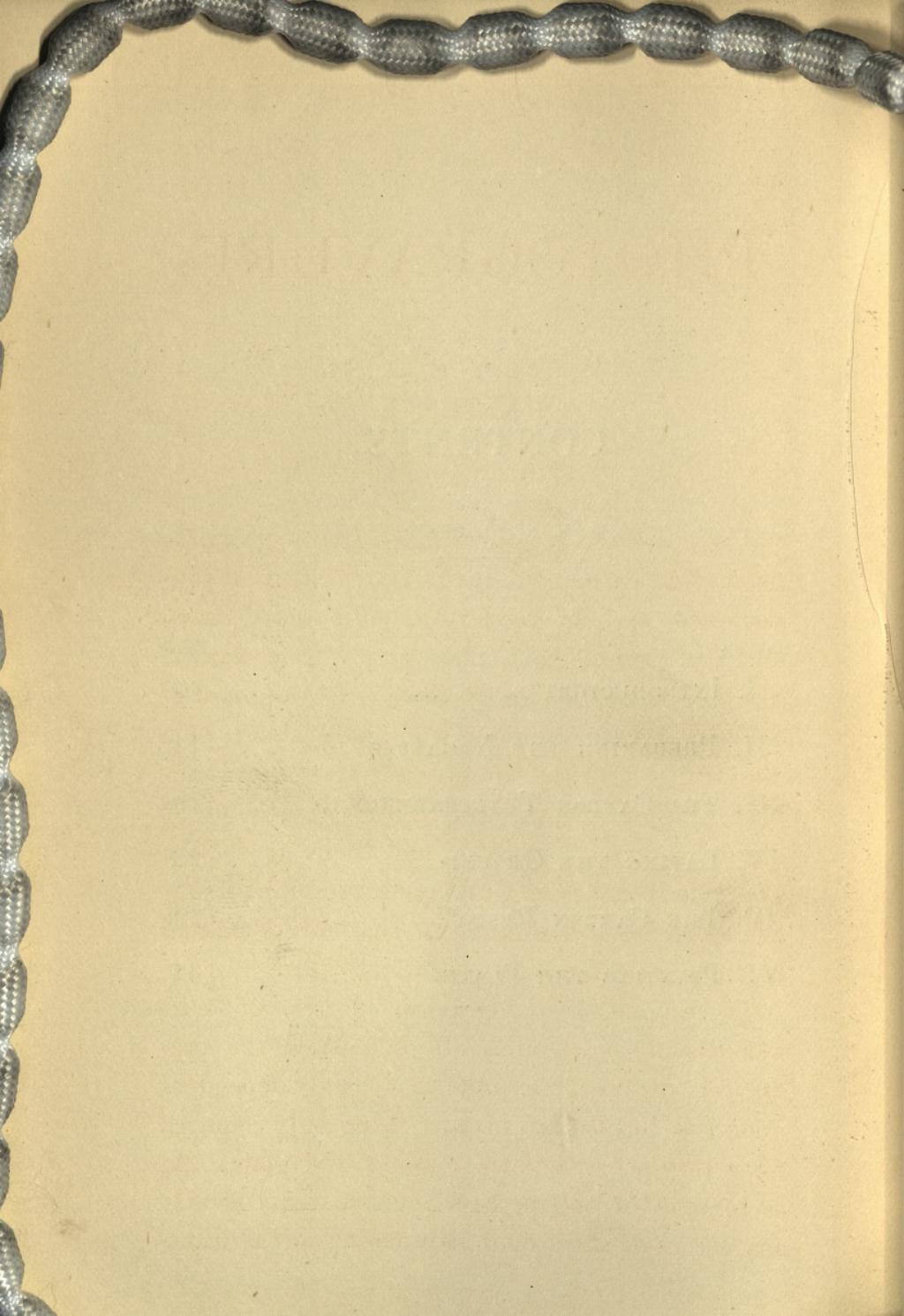
PRINTERS,

LONDON AND COVENTRY.

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# PHOTOGRAPHURE.

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## CHAPTER I.

### INTRODUCTORY.

The production of prints from favourite negatives, permanent, artistic in effect, in appearance, and in rendering, with the delicacy and truthfulness of a photograph from nature, has long been the aim of the great vanguard of amateur photographers, who have long been dissatisfied with the meretriciousness of ordinary photographic prints, which leave much to be desired upon all points, and their production as a rule trenches so much upon the limited time available for photography, that print-making becomes a nuisance instead of a pleasure.

The process of photogravure offers to amateurs a means of overcoming all difficulties, the production of the final proof not being dependent upon the light, that adjunct being only required for a very short time in making the plate. At each stage of the process the artist can modify any errors or shortcomings inherent to the trans-

lation of colour into photographic monochrome, so that the result will show more of the artist's interpretation of his picture than is possible with an ordinary photographic print.

As a process photogravure is simple, very interesting, and not at all tedious, and up to the last stage of printing from the plate requires little apparatus or material beyond that found in most amateurs' photographic dark rooms.

The production of a photogravure print may be divided into six stages (the negative, of course, being already made).

**FIRST STAGE.**—From the negative a transparency is made upon the special (transparency) carbon tissue, developing upon a prepared glass plate. Transparencies upon dry plates, unless made otherwise than by contact, cannot be used, unless a reversed negative be used. If made in enlarging camera the reversal of the image can be provided for.

**SECOND STAGE.**—From the transparency a negative in ordinary carbon tissue is made, for development upon a prepared copperplate; this carbon negative forming the resist in the etching bath.

**THIRD STAGE.**—Laying the etching ground upon a polished copperplate (conferring the power of holding the ink upon the copperplate) by dusting over with finely-powdered resin, or asphaltum, or by the air-brush, &c.

**FOURTH STAGE.**—The carbon image (second stage) is mounted and developed upon the prepared copperplate (third stage), and dried thereon.

**FIFTH STAGE.**—Protecting the margin, and etching in a solution of perchloride of iron, or of dilute nitric acid, then cleaning off the resist, and burnishing the margin and high lights when necessary.

**SIXTH STAGE.**—Printing from the plate, much in the same manner as copperplate etchings and mezzotint engravings are printed.

After the plate is proved, and retouched with burnisher and roulette, if many impressions are required, it should be steel faced—an operation not necessary for small numbers, and which amateurs may dispense with if preferred, and when one plate is worn out make another.

The apparatus required up to and including the fifth stage will be already in ordinary use

(excepting that required for the third stage), except perhaps a squeegee for mounting the carbon tissue upon the glass and copperplates, and which, by-the-bye, it will be as well to mention, must be a genuine squeegee of india-rubber for scraping pressure, not the useless rollers foisted upon amateurs as squeegees.

Carbon tissue (ordinary and special), bichromate of potassium, powdered resin, asphaltum, black varnish, washed whiting, washed emery powder, a mixture of equal parts vegetable naphtha and turpentine, plenty of clean soft rags, with bevelled and polished copperplates, comprise the materials used.

For the sixth stage, a copperplate printers' plant will be required, consisting of a copperplate press fitted with two blankets the size of bed-plate, one end being hung over the projecting pulley, the end of string being weighted with a piece of lead so as to lift the end of blankets from the plate when returned under the roller; a heater for warming the plate, consisting of an iron plate upon legs, with an atmospheric gas-burner underneath, or if gas is not available, a paraffin stove may be used; a jigger, a box with the end open, the top being used as a bench upon which to slide the hot copperplate from the

heater during the operation of inking up, the body of jigger holding a ball of whiting upon which the palm of the hand can be wiped, also as a receptacle for wiping rags, ink-dabber, &c. ; an ink-dabber or two made of flannel, rolled tightly, about an inch-and-a-half in diameter, and four inches long, the loose end being sewn to the body of roll ; a strong, flexible palette knife ; an inking slab, either an old litho stone or a plate of smooth zinc screwed down upon a wooden block ; copper-plate ink ; pigments in powder for modifying the ink in colour or in consistency ; burnt oil, strong and medium ; a bottle of turpentine ; Plate, India and Japanese paper for printing upon ; a sponge for damping the paper, a burnishing tool, and a roulette or two.

## CHAPTER II.

### PREPARING THE NEGATIVE.

The negative it is intended to make a photogravure plate from must be of the very best quality, free from blemish, well exposed, full of detail in lights and in shadows, strong without hardness, soft without flatness ; from hard, under-exposed negatives, it is useless expecting to get results in any way approaching satisfactory, therefore such negatives should not be tried. Flat, over-exposed negatives may be improved by reproduction, making a transparency from it in carbon, intensifying the carbon image by flooding with a strong solution of permanganate of potash, and from this transparency making a negative by contact on a slow dry plate, such as Mawson's photo-mechanical plate, or making another negative in the enlarging camera.

In making negatives from carbon transparencies upon dry plates in contact, the best plan is to put the transparency into the dark slide film up, after cleaning the back and dusting the front ; then put a dry plate upon the transparency, film down, and close the dark slide—if a double slide is

used, some soft packing will be required to keep the two in close contact, which packing must be dark in colour.

The dark slide containing the transparency and sensitive plate is put into the camera, the lens of which is racked out of focus, and is pointed to a large sheet of white paper evenly illuminated, or pointed to the sky, when the exposure is made; the plate is developed by the operator's pet formula. By this means the reproduced negative, being exposed to the parallel rays projected by the lens, is quite sharp, the relief of the carbon tissue and the inequalities of the two glass plates being rendered innocuous.

If the negative is larger or smaller than the projected photogravure print, the carbon transparency must be placed in the enlarging camera, and a negative made from it by daylight the exact size required. When the original negative is too large, or too small, and is of the desired quality, instead of making a carbon transparency, the negative (with the subject required duly masked) may be placed in the enlarging camera, the film away from the lens, and a transparency made therefrom the size required, using a slow dry plate, giving a full exposure, developing with a well-restrained developer, so as to obtain clear

lights and strong shadows, the transparency when finished being very much too dark for lantern purposes.

When the original negative is the exact size required, the transparency should be made in carbon, as that process gives a far better chance of a successful result. For this purpose the special transparency tissue is used. The word "special" has nothing to do with photogravure, but is the generic name given to a carbon tissue made for transparencies, containing a special pigment, more finely ground, and present in larger quantities than is the case in ordinary carbon tissues intended for paper prints. Carbon tissue should be purchased ready sensitised, and in cut sizes, as the operation of sensitising requires proper appliances and experience in the work. Carbon tissue sensitised will keep good for a month if kept dry, and, of course, away from light.

Before exposing the sensitive tissue to light under the negative, a mask must be cut and placed on the negative so that the edges of the tissue are protected from the light. If this is not done, the tissue will not attach itself to the support upon which it is mounted previous to development by hot water. This shielding the edges is usually called the safe-edge.

As a photogravure print looks so much better with a good margin between the edge of picture and the plate mark, this, in conjunction with the safe-edge for the carbon prints, will be likely to lead to confusion unless definite measurements are given. Therefore, to avoid mistakes and to simplify matters, we will assume that a negative measuring five inches by four has been selected for the first trial in photogravure, and upon this assumption all dimensions given will be based.

## CHAPTER III.

### THE CARBON TRANSPARENCY.

To prepare the negative for making the transparency, first of all thoroughly clean the back, then in a piece of thin opaque paper cut an opening 4in. by 3in., place this in position upon the negative in a half-plate printing frame, place a piece of transparency tissue 5in. by 4in., or larger, upon the negative, black side next the film of negative, put in the usual backing, fasten up the frame, and expose to diffused light.

The exposure to light should be from twice to three times as long as that requisite for making a print from the same negative upon albumenised paper, as the details in the lights must show by transmitted light.

When the exposure is complete, remove the tissue from the frame and immerse in a dish of clean cold water. At once examine back and front for air-bells, which must be removed if formed. Soon after immersion the tissue will curl inwards, this curl as quickly relaxing, and presently the tissue will lie flat on the water. Just before this happens, slide a gelatinised plate

—prepared as below—under the tissue. Lift the plate and the tissue from the water, the black face of tissue being in contact with the gelatinised side of plate. Lay the plate upon the bench and squeegee the back of tissue vigorously first one way, then the other, so as to expel all water and air from between the two surfaces, and so cause the tissue to adhere to the glass plate by atmospheric pressure.

Let the plate stand for five minutes, then immerse in water at a temperature of 100° F. Allow it to remain in here for five minutes, then gently lift away the paper. Rock the dish, and if the water has got below 90° add more at 100°, and keep at this for ten minutes. Then lift out the plate and lave with the water until all the soluble pigmented gelatine is removed, then pour over hot water from a jug and give a final rinse with cold water.

Now examine the result, and if the image is free from blemish, and just a little darker printed than would be desirable in a paper print, the transparency may be put away to dry.

If the exposure has been too short, and details are wanting in the lights, or it is too dark and the shadows are choked, or there are any imperfections in it, let another be done at once, as until

a perfect transparency is obtained it will be utterly useless proceeding further. In case of failure with the first, utilise the experience gained in getting a perfect result next time.

To prepare the glass plates upon which the tissue is mounted, get some half-plates; spoilt negatives will do, if free from scratches. Clean them by soaking, first in hot solution of washing soda to remove the films. Then, after rinsing under the tap, and well scrubbing, immerse in weak acid. Again well wash, and whilst wet flow over a hot solution of

|                                   |         |
|-----------------------------------|---------|
| Gelatine—Nelson's No. 3 flake ... | 1 oz.   |
| Bichromate of potash ... ...      | 30 grs. |
| Water ... ... ... ...             | 20 ozs  |

Soak the gelatine till soft, then place the jar in a pan of cold water, put upon the fire and melt the gelatine; add the bichromate in fine powder, stir until dissolved, then filter.

The plates when coated are placed on a rack to dry, and when dry are exposed to daylight for five or six hours, to render the film of bichromated gelatine insoluble, after which the plates may be stored away, they keeping any length of time.

When the transparency is quite dry it is placed upon the retouching easel, and any spots or pin-holes present are carefully filled up with a fine

sable brush and Indian ink ; then, if any of the details would be better for a little touching, the student can now show his artistic abilities, and lift his work from a mere photographic transcript to an artistic picture.

Until the student is able to judge the effect of such retouching, it will perhaps be best not to do much on the first plate, but there is an undoubted power in the hands of a competent artist to greatly improve upon the original negative in many ways, especially in the direction of correct light and shade.

## CHAPTER IV

### LAYING THE GROUND.

The copperplate to form the intaglio block from which the prints are to be made, before having the carbon negative—to be printed from the transparency alluded to in last chapter—which is to act as a resist to the etching mordant, must be thoroughly cleaned and polished, then a ground laid upon it to give an ink-holding grain to the surface.

The size of the plate to be used for the picture, 4in. by 3in., will be what is called large 16mo, measuring  $5\frac{1}{2}$ in. by  $4\frac{3}{8}$ in.; the edges should be slightly bevelled, and the surface well polished before purchase.

Lay the plate upon the bench, sprinkle the surface with a little of very fine emery powder—much finer than the ordinary flour emery—moisten this with a little of a mixture of equal parts of vegetable naphtha and turpentine, polish thoroughly with a piece of clean lint until the whole is quite dry and bright, now sprinkle with

a little washed whiting, moisten with the naphtha and turpentine mixture, and polish off with another clean piece of lint.

The copperplate must be thoroughly polished, and quite free from scratches. Therefore do not hurry over the operation, but take great care and polish well.

The plate being polished, the edges and back entirely freed from all traces of emery or whiting, it is then ready for laying<sup>1</sup> the etching ground.

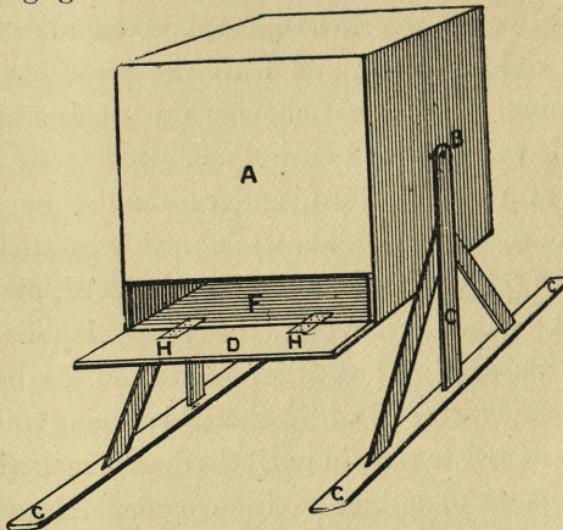


FIG. I.

For this purpose, a box, 18in. high by 12in. square, hung in a stand (C C) by the pivots B. See fig. 1.

An opening at the bottom of front is four inches high, fitted with a door (D) hinged from the bottom. The bottom of box (F) should have a number of inch wire nails driven into it, about an inch apart, to rest the copperplate upon.

To use this box put into it about a pint of very finely-powdered resin and asphaltum in equal parts, close the door, and revolve the box rapidly for a minute or so, then return to its original position. Let it rest for a short time to allow the coarser particles to subside. Open the door, and place the polished copperplate upon the nails ; then close the door, and leave the plate for 15 or 20 minutes. Upon removing the plate from the box it will be found entirely covered with a thin film of very fine dust, and care must be taken not to subject the plate while in this condition to a draught, or the dust will be displaced, and the effect spoilt. Directly the plate is removed from the dusting box, it is placed upon the heater, the temperature of which should be about 150° F., and allowed to remain until the dust is melted just sufficiently to adhere to the copper. Here very great care is required. The plate must not be subjected to too great a heat, or allowed to remain too long upon the heater, else the resin and asphalt will form a homogeneous film, instead

of a collection of very fine particles, through the interstices of which the etching fluid can penetrate.

Copperplates so prepared will keep any length of time, so if more convenient a number may be prepared at once for future use.

There are other methods of laying the ground, one by means of the air-brush, the spoon being filled with a solution of asphaltum, or of a resin in turpentine, or any suitable solvent; a scent spray with the two bulbs may also be used for this purpose, charging the bottle with a filtered solution of asphaltum, or of a resin, or gum in turpentine, or spirits of wine. With either of these spray methods the operator has a great power of altering the size of the grain, both generally all over the plate, as well as locally, and either of them are well worthy of trial. Grounds laid by these spray methods require no heating, as the solvent in evaporating leaves the resin, or gum, or asphalt in the proper condition to resist the acid and to allow the carbon negative being mounted thereon. The proportion of gum, resin or asphalt should be as near saturation as possible, and the solution must be filtered before use, or the passages will be clogged, and the action stopped.

The old methods of laying the grounds for aqua tint engraving, with solutions of resin in spirits of wine, are as follows: In a corked bottle make a saturated solution of the best white resin in strong spirits of wine, allowing some days, with occasional shaking, to get complete saturation. Now have two other bottles ready, and label them No. 2 and No. 3—the one containing the resin solution being No. 1; into No. 2 bottle put one ounce of solution from No. 1 and two ounces of spirits of wine; into No. 3 half-an-ounce from No. 1 and two ounces of spirits of wine.

The spirits of wine must be quite free from water, and to ascertain this, place a small quantity of gunpowder into a spoon, mix this with a little of the spirits, and ignite; if the powder explodes, the spirit is good, but if it remains at the bottom of the spoon, black and wet, water is present, and the spirit is useless.

To try the solutions, pour a little of the liquid from each bottle (draining each lot back into its own bottle) upon the plate, then lay it horizontally until the spirit has evaporated; then, with a magnifying glass, examine the three deposits of resin, and judge the size of grain suitable for the purpose. If none are satisfactory, other mixtures in different

proportions of spirit and solution of resin may be made. To lay the ground, the plate must be polished and held over a dish. The resin solution is then poured over at one steady sweep, and when all the surface is covered the plate is put on a level surface to dry; when dry, the plate will be in the same condition as the dusting method after melting the dust.

Another method of laying the ground is to make a five per cent. solution of camphor in methylated chloroform, and a five per cent. solution of white resin in benzole, mix, then coat the polished plate, and dry in a level position; when dry, put upon hot plate until the camphor ceases to smell, and the resin begins, then cool, and the ground is ready.

Another method is to oil the copperplate with olive oil, then to dust over with flour of sulphur, and allow to remain a few hours, when a slight tint will be etched all over the plate, more or less deep in proportion to the time given. These plates must be cleaned with ammonia before the next stage.

Bay salt     ...     ...     .. 2 parts.

Ammonium chloride     ... 1     ,

Verdigris     ...     ...     ... 1     ,

ground into a fine powder, mixed with syrup of

honey, also gives a good grain, and may be used after etching to vary the tints.

The old mezzotint ground laid with an instrument called a cradle, and a roulette also can be utilised, and offers the artist many methods of giving individuality to his work.

## CHAPTER V.

### THE CARBON RESIST.

The transparency being retouched, a mask is cut  $4\frac{1}{4} \times 3\frac{1}{4}$ , and upon this mask lines are drawn a quarter of an inch away from the edge all round. Put the transparency into the printing frame, and upon the transparency place the mask in position, pencil lines up, getting the image in the centre of the mask opening. Now cut a piece of ordinary carbon tissue (not transparency)  $4\frac{1}{2} \times 3\frac{1}{2}$ , and put this, face down, upon the negative and within the pencil lines on the mask, so as to get the image exactly in the centre of the tissue; the frame is fastened up and exposed to light, timing the exposure by means of a Johnson's actinometer.

If printing on carbon tissue is a new process to the student, it will be as well to experiment with a few prints, developing upon glass until a certain degree of proficiency is attained.

As a guide for exposure, from four to six tints, with a Johnson's actinometer, will be a good

average to start from, increasing or decreasing as required. Whilst the tissue is exposing, the copperplate, upon which it will be subsequently mounted, must be prepared, first by polishing, then by laying the etching ground, to give a tooth sufficient to hold the ink during the process of printing the proofs.

The tissue under the transparency being exposed, it is removed from the printing frame and placed in cold water, and when the curl relaxes it is squeegeed down upon the prepared copper-plate. When thus mounted, place under a weight for a few minutes; then immerse in warm water at 95° F. until the paper backing is loosened, so that it can be stripped off; then add more hot water, and lave the plate until the whole of the soluble pigmented gelatine is washed away, raising the temperature of water to 110°, if necessary, on account of over-exposure in the printing frame. When properly developed, rinse under the tap, then put away to dry.

When the carbon image is dry, the margin of bare copper is carefully covered with either black varnish, or with thick spirit varnish laid on with a brush, great care being exercised not to encroach upon the picture. When this is dry, the plate is at once placed in the etching fluid,

consisting of—

Saturated solution (in methylated spirits  
of wine) of perchloride of iron ... 5 ozs.  
Water ... ... ... ... 10 ,

Watch the result carefully, and as soon as the whole of the protected copper underneath the carbon image is discoloured by the perchloride of iron, at once remove the plate, wash well, and, with a brush dipped in a strong solution of carbonate of soda, clean off the whole of the resist. The operation of etching only occupies a few minutes, and must be closely watched, the action being traced by the discolouration of the metal, first in the shadows, then the half-tones, and finally the lights,\* at which point the action must be at once stopped.

The strength of the etching bath is only approximate; some pictures will require the use of stronger, others of weaker solution. The stronger the solution the slower the action; therefore the best way is always to begin with a moderately strong bath, and dilute with water until the plate is etched all over.

This etching must not be looked upon as a deep etching, because it is not so; really it is nothing

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\* Note that in the carbon resist the shadows are transparent and the high lights opaque.

more than a roughening of the surface sufficient to imprison the stiff ink used for printing.

If a copperplate, when the ground is laid, be immersed in a weak alcoholic solution of perchloride of iron, and the dish rocked for ten or fifteen minutes, the plate washed in turpentine and cleaned, if inked up with copperplate ink, would yield a black tint, much the same as a very fine chalk or crayon tint. And it is this tint, broken up by the varying thicknesses of the gelatine in the carbon image into lighter or heavier masses, which forms the ink-holding surface of the photogravure plate; but of actual depth there is none. Photogravure in this respect is very much like the old mezzotint process, in which the print is built up by the varying depth of the ink, the image being produced upon the plate by scraping and burnishing, to make the half-tones and high lights from the shadow ground.

|              |     |     |     |                    |
|--------------|-----|-----|-----|--------------------|
| Nitrous acid | ... | ... | ... | 1 part             |
| Water        | ... | ... | ... | 10 parts           |
| or           |     |     |     |                    |
| Nitric acid  | ... | ... | ... | $\frac{1}{2}$ part |
| Water        | ... | ... | ... | 12 parts           |
| Alcohol      | ... | ... | ... | 5 parts            |

may be used for etching instead of perchloride of

iron, but as they do not colour the copper, they are more difficult to manage by beginners.

When the plate is etched, the resist and varnish are at once cleaned off, the margin polished with fine emery cloth, protecting the picture with a thin straight-edge, then a proof must be pulled so as to see if any improvement can be effected with burnisher or roulette.

## CHAPTER VI.

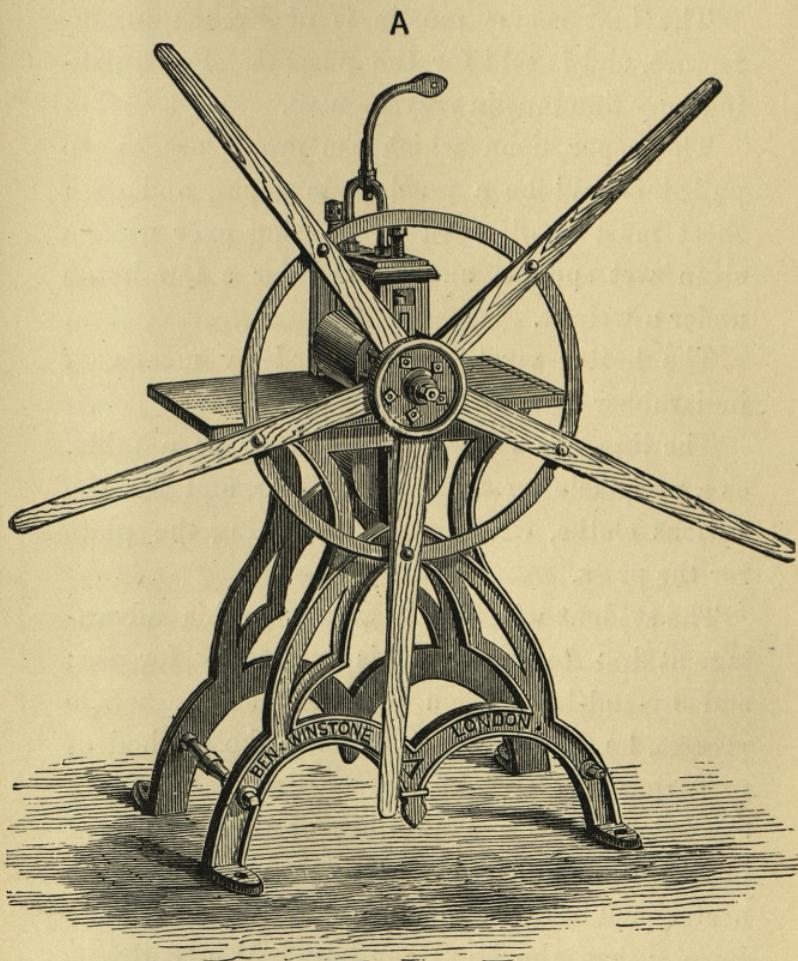
### PRINTING FROM THE PLATE.

The next operation will be to pull a proof from the plate, to do which it will be necessary here to give full instruction for printing from intaglio plates.

We now require a copperplate press. (See figure.)

Fitted with two blankets, a thick one next the rollers, a thin one underneath, and a piece of millboard on the bed of press, upon which to lay the plate. The blankets are generally hung up by a string passing over the pulley A, and weighted so that the blankets are raised as the pressure is removed.

For photogravure plates the ink must be strong, both in colour and in oil, being mixed by grinding with a stone muller on a slab. Frankfort black is easily ground, Paris black being brighter and harder, any desired modification being obtained by the admixture of burnt sienna, or burnt umber, or of lake and Prussian blue. The ink is applied by a dabber made from a roll of



cloth or flannel, about four inches long and one in diameter. For finishing the plate, two grades of muslin will be required, coarse for wiping the plate and soft for finishing.

The best coarse muslin is of French manufacture, and is sold for the purpose. For finishing, any fine muslin may be used.

The paper upon which the proofs are to be pulled should be a good plate paper, and each sheet must be damped by rubbing over with a clean wet sponge, and stacked for a few hours under a weight.

The heater must be connected by means of indiarubber tube with a gas supply.

The jigger is a small box serving as a table, as a receptacle for a ball of whiting, and for the various cloths, &c., used in preparing the plate for the press.

The student will find it greatly to his advantage at first to purchase his ink ready for use; and by-and-bye, when proficient at the whole process, he will better understand the method of preparing it. To take a proof, the plate is well cleaned, first with a mixture of turpentine and naphtha, and wiped dry. It is then placed on the heater, and allowed to remain until just a little warmer than the hand can bear. Whilst this is being done, take a dab of ink out of the can and put on the slab; dip the end of dabber in the ink, and work it on the slab. When the plate is sufficiently hot, place it on the jigger, protecting

the fingers with a piece of cloth. Dab all over with the ink, working it well into the engraving.

Now with a pad of coarse muslin, warmed, wipe the plate gently so to remove the ink from the margin and whites. Then make a cushion of three or four ply of fine muslin, just large enough to lay on the palm of the right hand. Warm this muslin, and proceed to wipe the plate with light pressure round and round until ink is only left in the depths of the picture.

The cushion of muslin gradually charges itself with ink, and consequently the surface of plate cannot be entirely cleaned, the cleanest parts having a thin tint upon them, and it is now that the printer can exercise his judgment as to which portions are to be white. The finger clothed in a piece of fine muslin, or a pencil of wood, or an ordinary stump, may be used to give special prominence to any desired portion of the picture.

The ink when cold adheres strongly to the plate; therefore it, and the muslin, must be kept warm in order to ensure even wiping.

The plate being wiped, the margin and bevelled edges are cleaned with a rag dipped in turpentine. The plate is then put on the press, a piece of damp paper in position, the rollers revolved, and the print is made.

Remove the plate from the press, and slightly warm upon the heater before removing the print.

This printing from the etched plate is not a very easy one, so the student must expect to be some time before he can turn out a really good pull from his plate. When a good pull has been obtained, it should be carefully examined, and if the picture is deficient in the high lights, a burnishing tool (judiciously used) will soon remedy this defect, the shadows being strengthened by means of a roulette, but do not touch the half-tones. When the plate has been proved, the next operation will be to steel-face it, for which purpose it is thoroughly cleaned with whiting moistened with turpentine and naphtha, polishing with a soft cloth; a small portion of the plate behind is scraped clean, and a piece of copper wire soldered to it. The steeling solution is placed in a wooden cell, the positive and negative poles from the battery (Leclanche) ending in copper rods the whole length of the cell. The solution is composed of

Warm water ... ... ... 20 ozs.

Ammonium chloride ... ... 3 ,,

Sulphate of iron and ammonia ... 4 ,,

When dissolved filter, and let it stand in the cell 24 hours before use. When required for use,

the copperplate is hung upon the rod connecting with the negative pole of battery, the positive pole being occupied by the anode (a plate of pure steel), which must be the same size, or larger than the copperplate. The two plates being in position, the current is turned on by pushing in the rod of battery, and in from three to five minutes the operation is complete, the copperplate being covered by a very thin film of steel. The plate when steel-faced is thoroughly washed and dried, and then cleaned with whiting and turps and naphtha, the copper wire behind carefully unsoldered, and the back scraped flat. If the battery is not to be used again for some time, the anode should be removed and wiped dry, the cell being carefully covered up.

A photogravure plate is very shallow, and requires a very strong ink to give the requisite depth in the print. Therefore it will be very essential that the student should be able to mix his own ink. To do this a muller and slab must be obtained, together with oil, strong and medium, and the various pigments, the ink being made by grinding the pigments in the oil, on the slab, with a muller. For a strong ink the maximum of pigment is ground with a minimum of strong oil, the grinding being in-

complete unless every particle of pigment be incorporated with oil.

For printing proofs on India paper, a piece of India paper is placed on the inked plate, the thick plate paper well damped being put upon the India paper, and when the impression is pulled, the India paper adheres to the plate paper. Be very careful in warming the plate after pressing, and lift the print away carefully.

Prints are dried separately; then, when both ink and paper are quite dry, damp again slightly, lay tissue-paper between each, and place under a weight until again dry.

Titles may be put by covering the whole plate with a thin film of bitumen varnish, then writing the title with an etching needle (writing backwards of course), taking care that the needle goes right through the varnish; now immerse for a few minutes in the etching solution, clean off the resist, and the plate is ready for printing.

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